

The Hunt for the Most Wanted Grids In America – Who Will be FFMA #2?

Kevin Kaufhold, W9GKA

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Revised September 2008 by Sean Kutzko, KX9X

Fred Fish and his Quest for all-US Grids

Since the development of grid squares in 1983, thousands of amateurs have obtained VUCC on 6 meters. Many have even achieved 6 meter DXCC, WAS, and WAC. But only one person has ever worked and confirmed every grid square in the continental United States – Fred Fish, W5FF.

During the 1960's and 1970's, Fred concentrated on 2 meters. By the late 1970's, Fred bought a Swan 250 to monitor 6 in hopes of catching 2 meter E-skip openings. Fred's wife, Lee, K5FF, then became seriously interested in 6 meters.¹ A large dish was built in the late 1970's at the Fish's house in New Mexico to work EME QSO's on 2, 220, and 432. In the following years, Fred and Lee amassed numerous accomplishments and VHF operating awards. Fred achieved WAS on 6 meters in 1979. The next year, both FF's obtained WAS on 2 meters. In 1984, both accomplished WAS on 220, a feat that was engineered by Lee's 220 newsletters as well as through Fred's portable EME expeditions. Along the way, 432 WAS and WAC on 2 and 432 were also obtained. During most of the 1980's and 1990's, Fred led the VUCC list on 6 meters, and both Fish's had many DX "firsts" on 6 meters. Then, in early 1990, Lee "went over the top", becoming the first person to ever confirm 100 countries on 6 meters. Fred was DXCC #2 on the band.²

In spite of all of these astounding accomplishments, one personal operating challenge still eluded Fred: working and confirming all grids in the continental United States. Including all grids that could be driven to in a vehicle, Fred counted up 484 grids that were within the physical boundaries of the "lower 48". By late 1994, he had confirmed all but three grids in the contiguous states.

As summer 1995 approached, Fred contacted anyone who could possibly travel on short notice to these three grids, all located in the East coast. After much liaison help from WA5UUD and several attempts with WA4VCC and K4MQH, Fred finally completed a CW contact on June 15, 1995 with WA4VCC in FM26, NC. Then:

“... on June 18 ... Fred chatted with Kevin Higgins, K1GAO, who volunteered to hop in his car and drive over to FN67. The two kept in contact while Kevin made his way north through the Maine woods. The band was dying out as Kevin crossed the line, but Fred made it into FN67 at 2025. There was just one grid to go!

The following day, Fred was back on the air calling CQ towards Maine ... Fred’s wife Lee, K5FF, was on the phone with Peter Stackpole, N1MLE, in FN64 and convinced him to get on 6 meters. Fred and Peter then completed easily on SSB for Fred’s 484th and last continental US grid.”³

Even though working 484 US grids was merely a personal goal of Fred Fish, the VHF-oriented press took note. Articles appeared in both *QST* and *CQ*, and the following iconic picture was also in *QST*.⁴



Shortly after the announcement that Fred Fish had confirmed 484 grids, two amateurs who were highly knowledgeable of geographic contours of the US, Curt Roseman, K9AKS, and Emil Pocock, W3EP, contacted Fred. They mentioned to Fred that several

off-shore islands and sand bars were claimed by different states. If the definition of “continental” US included any land mass within the territorial jurisdiction of the contiguous states, an additional four grids would be included, raising the total to 488 grids. Fred didn’t realize anyone would care about these nearby islands, but of course, he had already worked the extra four grids!⁵

To this day, Fred Fish remains the only person to have ever worked either the original 484 grids or the more expansive 488 grids of the continental United States.

The Development of an Award

Fred Fish died shortly before the 2005 CS VHF Conference, and news of his passing was a great blow to many. Fortunately, Fred’s wife, Lee Fish is still alive, and has kept up on some VHF activities.

Bill Van Alstyne, W5WVO, relocated to New Mexico in 2002. As soon he got on 6 meters at his new QTH, he started hearing about Fred Fish, W5FF, and his wife Lee, K5FF. Their many VHF firsts were still being talked about on the Magic Band. During that first summer on 6 meters, Bill scarcely completed an E-skip QSO where he wasn’t asked if he knew Fred. It quickly became clear to Bill that Fred was very much loved in the VHF amateur community, not just as a talented and capable amateur, but as one of those rare human beings who was always ready to go above and beyond to help somebody else. The most fondly recounted tales W5WVO heard on the air were about Fred’s kindness, generosity, and enthusiasm for amateur radio.⁶

Via the VHF e-mail reflectors, W5WVO then proposed an award in July, 2007, for working all continental grids on 6 meters. Dubbed the Fred Fish Memorial Award (FFMA), the concept immediately drew the attention of a core group of VHF amateurs, namely, Sean Kutzko, KX9X; Paul Kiesel, K7CW; and Kevin Kaufhold, W9GKA. Within short order, a user’s group was established. Over the next several months, the FFMA Yahoo User’s Group developed proposed rules, integrated the concept into the existing VUCC structure, and more clearly defined the continental US grids. Lee Fish was even contacted for her input on an award. She was very enthused about the concept.

The FFMA User’s Group currently has over 70 members, and maintains many historical and data files at its Internet location. Much information is also available on the rarest grids in the country, and planning is underway for future Grid DXpeditions. Everyone is invited to join. The group is located at: <http://groups.yahoo.com/group/FFMA>

The User’s Group proposed the award to the ARRL in the fall of 2007. The user’s group also volunteered to pay for the cost of all plaques. By this time, Sean, KX9X had become ARRL Contest Branch Manager, and he volunteered to administer the award. Normally,

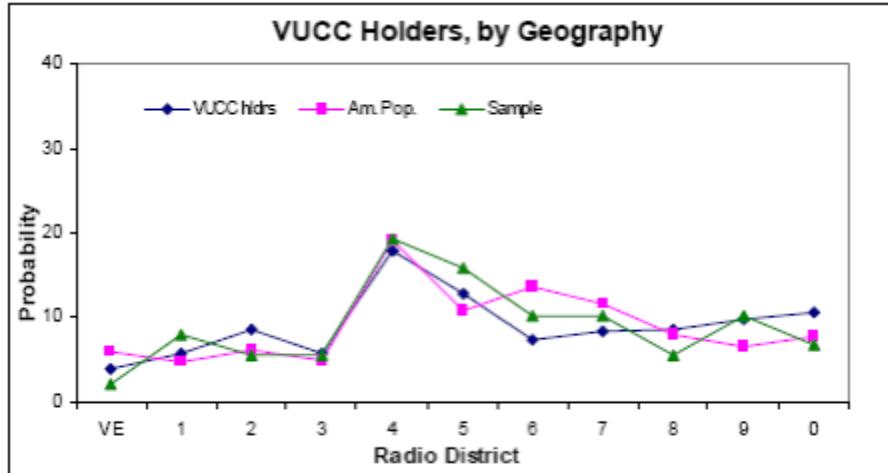
consideration of such an award would take many months and possibly even years before it would gain consensus of the various League committees. But, the concept had great potential to increase 6 meter activity, that the Program and Services Committee of the ARRL quickly recommended the League sponsor the award. In January, 2008, the ARRL Board voted unanimously to establish the Fred Fish Memorial Award. The award will be dated and serial-numbered for contacting all 488 grid squares of the 48 contiguous states on 6 meters. The Board also voted that FFMA #1 be issued posthumously to Fred Fish and presented to his wife Lee Fish, K5FF.⁷ ARRL information on the Award, including the award rules and a list of all 488 FFMA grids, can be found at:

<http://www.arrl.org/awards/ffma/index.html>

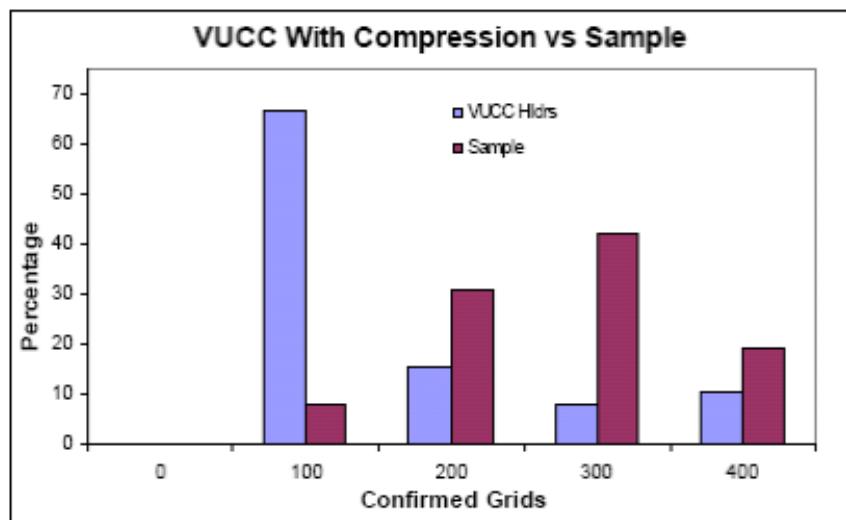
The FFMA 6-Meter Grid Survey

Early in the process, the FFMA User's Group realized that information was sorely needed on which grids were the most difficult to work and confirm. Great effort and energy was then given to the development of a survey that could determine the "most wanted" grids. Care was taken to maintain statistical controls and standards throughout the development and collection phases of the survey. The targeted group was any VUCC holder having at least 200 confirmed grid squares. Hundreds of e-mails were sent out to this audience, and a professional-level survey form was utilized. Only responses from people within this defined group were accepted. 88 full responses were received, and partial responses were collected from 14 more people. Results of the survey are thought to be statistically significant at the 95th confidence level. The survey ran over 50 pages in length, and can be found at: <http://www.arrl.org/awards/ffma/index.html>

Survey responses were geographically representative of the general amateur population and the entire VUCC population. This was an important consideration, as there was some belief that distance from a grid might be a factor in whether a grid was "rare". The following graph contained in the survey shows the geographical diversity of responses.

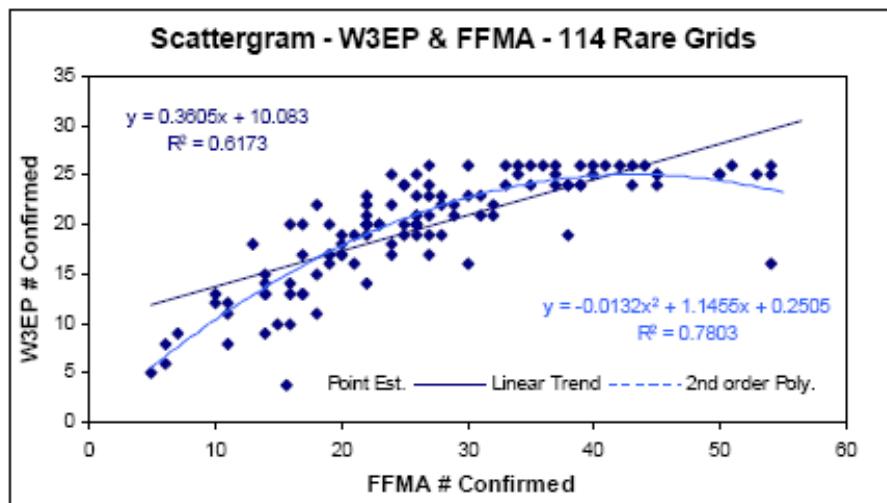


With the survey concentrating on the VUCC population above 200 confirmed grids, the sample participants were certainly among the more experienced VHF operators in the nation. This was thought to be particularly important, as this group would be the ones most interested in chasing rare grids. The survey's tilt towards the more accomplished VHF stations is shown in the following graph, also taken from the survey.



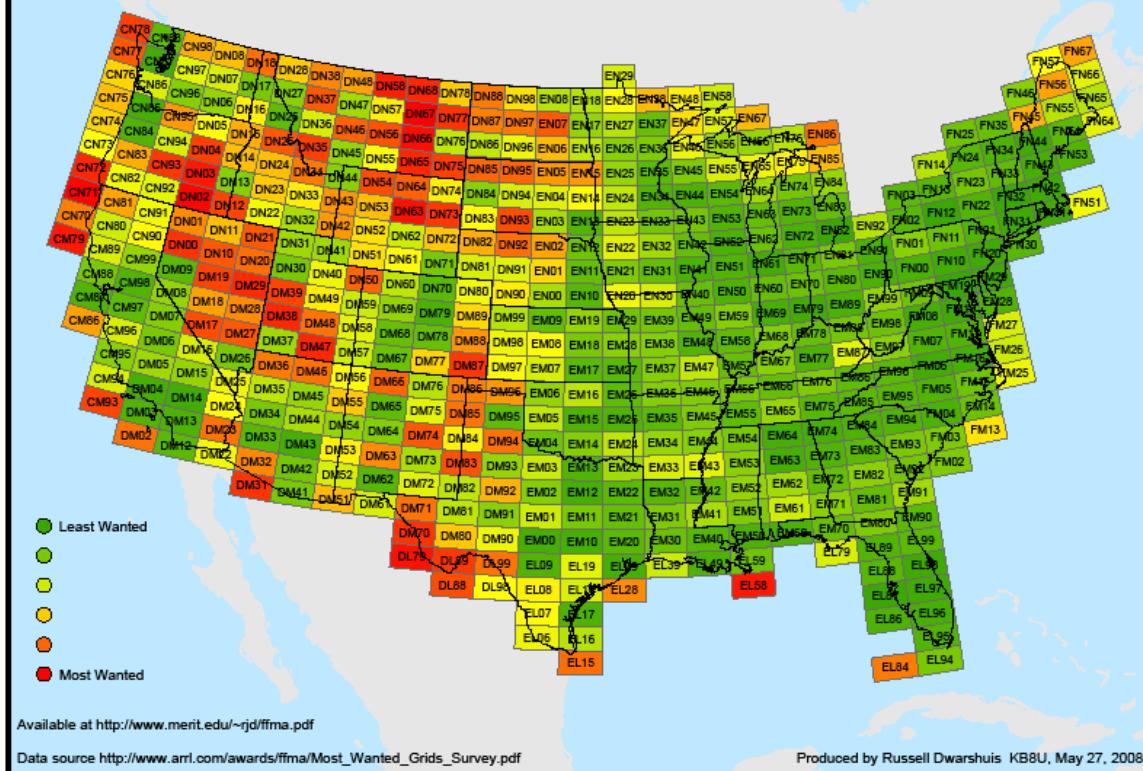
As the survey progressed, it was determined that another survey on the same topic matter was being independently and simultaneously conducted. Done by Emil Pocock, W3EP, this survey used the same 488 grids as did the FFMA survey, but utilized somewhat different statistical techniques. In particular, the W3EP survey was even more concentrated on the grid leaders, sampling only those stations above 500 confirmed worldwide grids. At first, there was a concern that different surveys would normally

generate different results, even under the best of circumstances. With a different methodology, results might be far off between the two surveys. Much to the surprise of the user's group, results between the two surveys were very close (it should be added that W3EP thought all along that results would be similar). This actually lends greater credibility to the results of both surveys. The following graph shows the closeness in rankings of "rareness" between the two surveys of the 114 grids surveyed by W3EP:



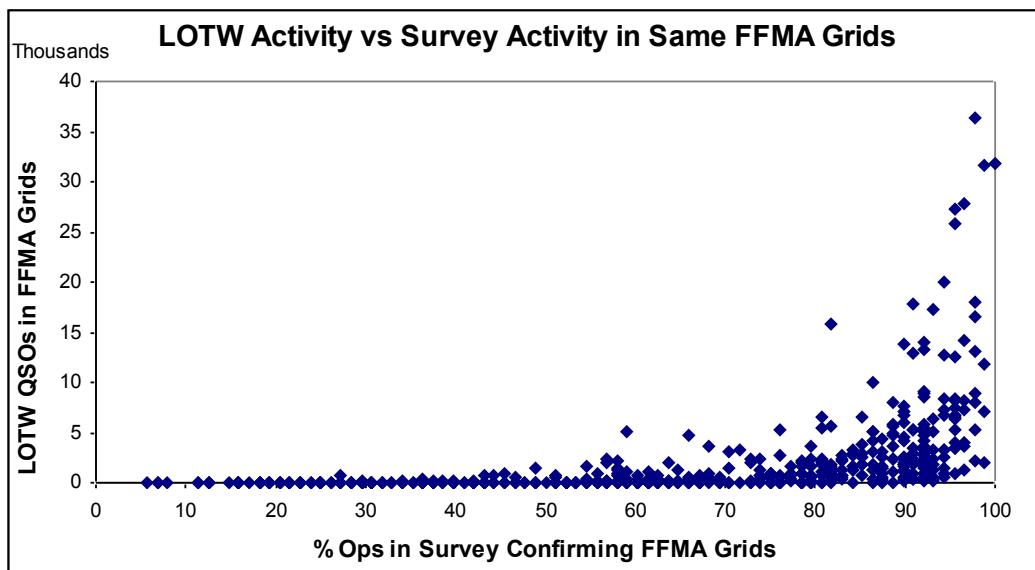
The FFMA survey focused on the top 24 rare grids in the nation. Detailed information on each of these grids is included in the survey. Several other grids thought to be rare among the more general VUCC and VHF populations were also identified and discussed. A map of the top 24 grids was included in the survey results. Subsequent to the original survey being conducted, one of the members of the FFMA user's group, Russell Dwarshuis, KB8U, used the statistical results of the survey to develop a map showing the relative rareness of all 488 US grids. Every grid could now be visually identified for its "most wanted" status. What becomes more apparent than with the original conclusions of the survey, several east coast grids are more clearly identified as being not so common (although still not extremely rare). This is important for west coast stations who likely need these far-away eastern grids. The map showing all 488 grids follows.⁸

Fred Fish Memorial Award Most Wanted Grids



Note in the above map that much of the west is exceedingly rare. Several adjoining grids are among the most wanted, in fact (DN67, 66, 77, 76, for example). This “clumpiness” is another indication of credibility of results, as grids having similar population and similar geographic features, quite naturally should have similar findings as to most wanted status.

Also subsequent to the original survey, in May 2008, FFMA Users Group member and ARRL Contest Branch Manager Sean Kutzko, KX9X, with the assistance of ARRL Web Manager Jon Bloom, KE3Z, identified in Logbook of the World (LOTW) all 488 US grids, and provided statistical output on the number of QSO's for each FFMA grid.⁹ Sean cautions that it will be some time before LOTW can support VUCC. But even the identification of the FFMA grids within LOTW is an encouraging sign of the long-term potential of LOTW. Kevin Kaufhold, W9GKA, then compared the FFMA survey results against LOTW QSO's, and discovered a close correlation between QSO's and the survey's ranking of "rareness". This is yet another indicator that the survey may have generated very worthwhile results, especially considering that LOTW QSO data is considered a data source external to the survey itself. The following graph shows the comparison between LOTW data and survey results.¹⁰



A ranking of all 488 FFMA grids by “most wanted” status is contained in an addendum of the original survey. The top 24 rare grids of the survey are listed in the following table, which is extracted from the survey:

Grid	# Cnfrmd	% of ops
DN67	5	5.7
CN71	6	6.8
DN02	6	6.8
DN66	7	8.0
DL79	10	11.4
DN63	10	11.4
CM79	11	12.5
DN03	11	12.5
EL58	11	12.5
DN58	13	14.8
CN72	14	15.9
DM38	14	15.9
DM47	14	15.9

DN65	14	15.9
DN68	14	15.9
DM29	15	17.0
DM31	16	18.2
DM70	16	18.2
DN00	16	18.2
DN77	16	18.2
CN93	17	19.3
DL89	17	19.3
DM87	17	19.3
DN73	17	19.3

With the survey's concentration on VUCC holders having high grid counts, several other very challenging grids were not included in the above top 24 rare grid list. Statistically, this is likely the result of very experienced operators working very difficult grids on a single occasion many years ago (the DL88 W5OZI grid DXpedition in 1991 is a case in point). Professional statisticians refer to this as "selection bias", where the selection of certain survey participants or certain types of input data can bias the survey results. For those stations that have not been on 6 meters for very long, it is highly likely that these difficult-to-access grids would be very rare. *Therefore, on a cautionary note, the results of the FFMA and W3EP surveys should be viewed as identifying the grids that are rare to VUCC with high confirmed grid counts.* The grids that are subjectively thought to be rarer among the general VHF population than the survey participants include:

Grid	# Cnfrm	% of ops
CM93	19	21.6
DL88	20	22.7
DM02	26	29.5
EL84	27	30.7
EN67	37	42.0
FM13	44	50.0

The FFMA Leader Board – How Soon to FFMA #2?

The development of a leader board has been a common and consistent request by VHF operators. The organizers of the FFMA 6 meter grid survey (W9GKA, W5WVO) knew specifics on survey respondents. There was a general reluctance however to publish such information, since responses had been collected for the sole purpose of ascertaining rare grids, and not for disseminating information concerning specific operators. One of the survey respondents, Larry Lambert, N0LL, circulated to the VHF reflectors in early 2008 his own grids needed to complete FFMA. After that, several grid leaders also wanted to publicly state their needed grids. Some of the leaders even requested a more formalized list from the user's group.

So, the FFMA User's Group contacted all leaders from the survey to obtain updates on their needed grids, and informed each leader of the development of a leader board. Several new stations that were not part of the initial survey also provided their information. By May 2008, a leader board had been constructed which tracked the needed grids of all known leaders with 50 or fewer FFMA grids yet to confirm.

The FFMA Leader Board as of September 22, 2008, is as follows.

Call	District	State	Grid	US Grids	Status	Update
W5FF	5	NM	DM64	484 / 488	FFMA #1	19-Jun-95
K5UR	5	AR	EM35	485	3	Jun-08
WD5K	5	TX	EM12	483	5	Sep-08
W5OZI	5	TX	EM00	481	7	Jul-08
KM0A	0	MO	EM48	479	9	Jun-08
W9RPM	9	WI	EN43	473	15	Jun-08
N0LL	0	KS	EM09	472	16	Aug-08
K1TOL	1	ME	FN44	467	21	May-08
W0FY	0	MO	EM48	463	25	Jun-08
AA7A	7	AZ	DM43	459	29	May-08
W4UDH	4	MS	EM52	448	40	Aug-08

KB6NAN	6	CA	CM87	448	40	Sep-08
K7MCX	7	WA	CN87	446	42	Aug-08
K7CW	7	WA	CN87	427	61	Sep-08
K7WIA	7	WA	CN87	426	62	Aug-08
W0JRP	0	MO	EM27	415	73	Aug-08
W4DR	4	VA	FM17	414	74	Aug-08
W5WVO	5	NM	DM65	410	78	Sep-08
W3EP	1	CT	FN31	401	87	Sep-08

Anyone who would like to be part of the Leader Board should send their needed grids to W9GKA@ARRL.net. Updates by the existing leaders can also be sent to this same e-mail. An excel file containing the latest version of the FFMA Leader Board, complete with all grids needed by each leader, can be found at the FFMA User's Group.

With several leaders very close to confirming all US grids, it may be only a short time before someone achieves FFMA #2. While there are probably other stations that have not yet become knowledgeable of the leader board, chances are that one of the individuals on the above list will ultimately become the second person to work and confirm all 488 continental US grids.

The following table ranks needed grids among the above FFMA Leaders, and then compares that ranking with the 6 meter grid survey. Notice the similarity of grids needed by both the leaders and the survey participants.

Grid	Leaders % Needed	Survey % Needed	Survey Rare?
CN71	66.7	93.2	. Top 24 .
DN67	58.3	94.3	. Top 24 .
CM79	50.0	87.5	. Top 24 .
DN66	50.0	92.0	. Top 24 .
EL58	50.0	87.5	. Top 24 .
DL79	41.7	88.6	.. Top 24 ..
DM29	41.7	83.0	. Top 24 .
CN70	33.3	68.2	
CN72	33.3	84.1	. Top 24 .
CN77	33.3	75.0	
CN93	33.3	80.7	. Top 24 .
DL89	33.3	80.7	.. Top 24 ..
DM31	33.3	81.8	. Top 24 .
DM38	33.3	84.1	. Top 24 .
DM87	33.3	80.7	.. Top 24 ..
DM94	33.3	70.5	
DM96	33.3	63.6	
DN03	33.3	87.5	. Top 24 .
EN86	33.3	69.3	
FN51	33.3	43.2	
CM93	25.0	78.4	rare
CN75	25.0	56.8	
DL88	25.0	77.3	rare
DM39	25.0	78.4	
DM66	25.0	72.7	
DM83	25.0	76.1	
DN00	25.0	81.8	.. Top 24 ..
DN02	25.0	93.2	. Top 24 .
DN12	25.0	78.4	
DN34	25.0	69.3	

DN35	25.0	79.5	25-28
DN58	25.0	85.2	. Top 24 .
DN63	25.0	88.6	. Top 24 .
DN65	25.0	84.1	. Top 24 .
DN68	25.0	84.1	.. Top 24 ..
DN75	25.0	79.5	25-28
DN77	25.0	81.8	. Top 24 .
DN87	25.0	68.2	
EL15	25.0	71.6	
EL84	25.0	69.3	rare
EN46	25.0	42.0	
EN47	25.0	51.1	
EN55	25.0	38.6	
EN85	25.0	58.0	
FM13	25.0	50.0	rare
FN64	25.0	39.8	
FN67	25.0	61.4	

What Makes a Grid “Most Wanted”?

With the rareness of US grids now well-established through both grid surveys conducted in 2007 as well as by the more recent development of the FFMA Leader Board, the question becomes: Why are certain grids so consistently difficult to work? The following thoughts represent the prevailing view of what makes a grid so rare.

1. No 6-Meter Presence. The most critical determinant in the rareness of a grid is the simple lack of 6-meter amateur presence and activity in the grid. It is no coincidence that the rare grids of the west have very low population densities. One area that is critically needed, eastern Oregon and upper Nevada (DN00, DN01, DN02) is even referred to by locals as the “big empty”. With low population levels in general, there will be even lower amateur population and 6-meter activity. The lack of LOTW QSO’s in grids identified as rare also point to a low amateur population as being the principal reason behind a grid being “most wanted”.

Conversely, the most common grids coincide with very populated areas along the east coast. One would normally think that the most common grids would lie in the center of the nation, within easy distance of both coasts as well as the south. Many grids in

the middle section of the country are somewhat common, but only one grid was confirmed by all 88 survey participants in the 6 meter grid survey: FM19, Maryland. This particular grid is home to numerous experienced VHF stations having great antenna systems and significant power levels. Dozens of ops from FM19 are in almost every minor and major 6-meter opening, as well as being heavily involved in VHF contests. Other very common grids in the east include New York City and adjoining major population centers.

Still, some grids with relatively decent population and amateur levels are consistently needed. CN71, Crescent City, CA, for example, has over 4,000 people and 135 amateurs. Such areas may be rare largely because of a lack of 6 meter activity among the local amateur population. Mountains to the east may also be blocking paths to the main part of the US in some of the coastal grids.

2. Location. There is some evidence that the distance to a grid may be a secondary factor. The FFMA survey wanted results reported to the 95th confidence level or greater. So there was no breakdown in results by geographic area of the survey participants, out of concern that too few of responses were received from particular areas to maintain such a high confidence level. The W3EP survey did provide breakdowns by geographic area, however. While results of that survey do not rise to the level of strict statistical standards, there was a general indication that distance to the grid was somewhat relevant. The overall results of the W3EP survey were consistent with the FFMA survey, but there were also local variations within the W3EP survey, with west coast stations needing many east coast grids, and east coast stations in constant need of western grids.

Also, historical evidence is illustrative, with the last three grids needed by Fred Fish all being along the east coast. Based in New Mexico, it is believed that W5FF worked out the western grids with friends who could quickly travel throughout the west. The east was far more difficult to cover, both because of the relative lack of very long E-skip openings, and the greater difficulty Fred had in finding people to travel into the rare grids of the East. Indeed, as noted in the opening paragraphs of this paper, Fred and Lee made contact to several people in order to locate anyone who could activate the last few grids. Location of the grid certainly played a role in W5FF confirming all US grids.

3. Physically Challenging Areas. Some grids are just outright difficult to get into and out of, regardless of population and / or distance from the QTH. Physically hostile conditions exist in many of the southwestern areas, and several grids have little or no access, by either land or sea. One grid – CM79 – is a good example. This grid is located in a wilderness area at the very edge of the Pacific Ocean in Mendocino County, CA. Amateurs must pack-back in and out of an area with very rugged terrain. Once inside the grid, operators find themselves facing the Pacific Ocean, with steep

mountains to the East. As a result, Japanese stations may be just as likely to contact a DXpedition into this grid as are US amateurs!

In general, there are two kinds of rare grids. The first is composed of the western interior – any number of grids qualify here. This is mostly a matter of local population and amateur population densities. The second set of rare grids involve land and sea border areas. Many Mexican border grids are very rare (DM31; DM79; DL89; DL88; DM70). Several coastal border and island-only grids are also rare (EL84; EL58; DM02; CM93; CN70-72). In addition, some Canadian border areas have less common grids. These grids include EN67, EN86, FN 57, FN67, FN56, FN45. A more visually-oriented description of these rare grids will be made in the technical presentation at the 2008 CSVHF Conference, and detailed information on the top 24 rare grids in the nation can also be found in the FFMA survey.

Current and Future Plans to Activate the Most Wanted Grids

Recent and US Grid DXpedition activity included the following. Many of these trips were conducted by FFMA User Group members. Please send information on possible Grid DXpeditions to either: w5wvo@cybermesa.net or to: w9gka@arrl.net

- DN00 - DN03 rover 6, 2, 432 June VHF (W6DWI)
- DN03 active 6 - 432 June VHF (KI7JA)
- CN93 active in June VHF (KB7ME)
- DM74-75-76-84-85-86-65 rover June VHF (KK6MC)
- DM87 in June VHF, 6-432 (W0TTT)
- FN56 June VHF, 6 meters (K1UO)
- FM13, Ft. Fisher, NC active in CQ VHF (W4GRW)
- DN02 in July CQ VHF, 6-432 (KB7ME)
- DM29 sometime in 2008 ? (VE3CDX/W7)
- Alaska in June, 2009 (W6JKV)
- Eastern MT in July 2009? (FFMA planning)

Plans and ideas for activating rare grids include the following:

- Major Grid DXpeditions. The overall goal is to put the bigger grid trips on par with HF DXpeditions. This would involve regular, high-profile grid DXpeditions with significant amounts of equipment, power levels, antennas, towers, manpower, and planning. A week long stay at the peak of the Es season is envisioned to maximize the potential for widespread activation of the rare grids. Some form of sponsorship of the Grid DXpeditions is also a possibility.

- Elmer's Rare Grid DXpedition concept. The grid DXpedition would travel to a specific location, seeking assistance from local amateurs. The real goal is the permanent activation of the grid after the DXpedition leaves, perhaps with donated equipment or small antennas.
- Multiple rare grids from a grid square corner. Several very rare grids in the west adjoin one another. VUCC and FFMA rules both allow for the simultaneous activation of multiple grids from a grid line or corner, provided certain standards of proof are satisfied. Such an outing would be similar to State QSO parties that allow for multiple counties to be counted from a single location.
- Grid DXpeditions in a contest. Multiple grid squares are not allowed in ARRL and CQ VHF contests, so a corner grid trip would not be able to give out multiple grids during an actual contest. Nonetheless, a contest DXpedition would attract massive interest, especially if a portable station had KW power levels with good antennas at a decent height, and would be located in a very rare grid to begin with.
- Large DXpeditions with rovers. If a grid corner is not feasible, then a DXpedition could locate in a single grid in close proximity of a corner. An accompanying rover could then run to nearby grids during big openings. The main station could even act as an on-air spotter for the rover. In between openings, the rover would do double duty as the support vehicle for the DXpedition.
- Digital Activity. E-skip is not the only way to work a rare grid. The new digital modes could be highly successful for meteor scatter and marginal tropo situations. In fact, there is a far greater likelihood today of completing QSO's to rare grids via digital modes than completing SSB or CW contacts to difficult grids during the hey-day of Fred and Lee Fish. Every major Grid DXpedition should be equipped with digital abilities.
- Mobile Task Force. Taking a cue from the Fish's, stations that are active on 6 meters and within range of rare grids could be recruited to supply mobile activity into such grids during major band openings. A list could be developed containing these mobile forces, and used for impromptu grid activation. The concept could also be extended to include boats or even seaplanes that land on open water and then operate (aeronautical contacts do not count for VUCC or FFMA credit, but seaplanes that have landed do count, as well as all kinds of boats). Seaplanes and boats could also be used for longer grid trips, and some larger boats may be viable for DXpeditions to grids with difficult-to-access islands (EL84; DM02; etc).
- Public web-site. The FFMA user's group is currently very active. We envision the user's group continuing to play a major role in future organizational efforts. What is desired however is a more public place on the Internet where people could check for

planned grid activity, as well as having an interactive capability for updates on confirmed grid squares. As of September 2008, work has begun on a web site devoted to the activation of grid squares on Six Meters, and the FFMA award in general. This site should be operational by the 2009 Sporadic-E season. An announcement will be made to the VHF community upon completion.

- Non-Profit Status. Under very tentative discussion is the possibility of developing a foundation or other form of charitable organization that serves as a financial base for 6 meter rare grid activity. This could be something similar to the various DX foundations in existence. A foundation or other charitable device could then serve as the source of funding for well-organized trips to rare grids. More broadly, a charitable concept could be extended to include VHF activities across different bands, and for a variety of propagation and operational activities. Of note on this topic, the Northern California DX Foundation financially supported N6YNB's 1976 2-meter EME trip to Alaska so that K0MQS could complete WAS #1 on that band. A charitable clearinghouse for significant VHF operations may thus have long-term merit.

¹ From comments of W3XO, CSVHF document memorializing W5FF, circa 2005.

² Operating achievements of both W5FF and K5FF taken from W5FF Historical File, FFMA User's Group.

³ *QST*, Sept. 1995, at 112.

⁴ The picture and article on the feat is in *QST*, Sept. 1995, at 112. *CQ* articles include: *CQ*, Dec. 1994, at 92; and *CQ*, Oct. 1995, at 100. The picture has been incorporated into the official ARRL FFMA Award plaque.

⁵ From e-mail correspondence of K9AKS, maintained at FFMA User's Group.

⁶ Taken from "In Search of the Legendary Fred Fish", *CQ VHF*, Spring 2008, p.44-47.

⁷ From: <http://www.arrl.org/news/stories/2008/01/28/100/> , which is an initial announcement of ARRL sponsorship of the award.

⁸ The map can be found at: <http://www.merit.edu/~rjd/ffma.pdf>

⁹ An excel file containing LOTW QSO information on the 488 FFMA grids is contained at the files section of the FFMA User's Group.

¹⁰ The LOTW – FFMA graph can also be found in the files section of the FFMA User's Group.